Early or delayed sowing for improved ryegrass control: summary of three seasons

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Key findings

- Delayed sowing provided no advantage over early sowing in reducing ryegrass plant or head number.
- In two out of three seasons, later sown crops were lower yielding and did not provide as good crop competition allowing ryegrass head number to increase.
- Sowing time had no effect on the performance of pre-emergent herbicides for ryegrass control.

Why do the trial?

In 2008 a ryegrass control trial at Hart showed the best additional management strategy to herbicide application was delaying sowing by seven days (Hooper 2008). Delayed sowing reduced ryegrass numbers by 55% for all herbicide treatments. However, this strategy often results in lower grain yield and a less competitive crop against any surviving ryegrass.

Since this research was conducted, the introduction of new residual pre-emergent herbicides has reduced the reliance on post emergent selective grass sprays and provided an improved option for dry sowing. Pre-emergent herbicides however, have more variables that can affect efficacy than post-emergent herbicides. This is because pre-emergent herbicides are applied before the weeds germinate and a number of considerations (eg. soil moisture, rainfall, soil type) come into play. Anecdotal grower evidence suggests dry or early sown crops, using adequate rates of residual pre-emergent herbicide provides similar levels of ryegrass control to delayed sowing with an additional one or two knockdowns. The aim of this trial was to investigate the effect of early or delayed sowing on reduction of ryegrass numbers in combination with different pre-emergent herbicides.

Pre-emergent herbicides trialled

Across three seasons the efficacy of pre-emergent herbicides on ryegrass were trialled in combination with time of sowing. To ensure even annual ryegrass establishment across the trial site, seed was broadcast the year prior to trial establishment at a rate of 25 kg/ha. Prior to seeding an additional 5 kg/ha ryegrass seed was spread and lightly tickled in.

The trial was a split-plot design with one wheat variety (Scout 2014, Estoc 2015, Mace 2016), two times of sowing and six pre-emergent herbicides (Table 1).

Table 1. Pre-emergent herbicide treatments evaluated in time of sowing wheat trials at Hart in 2014 - 2016.

Treatment no.	Herbicide and rate applied
1	Nil
2	IBS Boxer Gold 2.5 L/ha
3	IBS Sakura 118 g/ha
4	IBS Boxer Gold 2.0 L/ha + IBS tri-allate 2.0 L/ha
5	IBS Sakura 118 g/ha + IBS tri-allate 2.0 L/ha *2015 & 2016 IBS trifluralin 1.5 L/ha + tri-allate 1.6 L/ha*
6	IBS Boxer Gold 2.0 L/ha + PS (crop 2-3 leaf) Boxer Gold 1.5 L/ha *2015 & 2016 IBS Prosulfocarb 3.0 L/ha*

Pre-sowing herbicides were incorporated by sowing (IBS) within a few hours of application. Post sowing Boxer Gold was applied at the 2-3 leaf crop growth stage. Annual ryegrass control (plant and head number), and wheat grain yield and quality were assessed each season.

Results and discussion

Grain yield and quality

Grain yield was higher for the early time of sowing in the two seasons (2014 and 2015) characterised by dry and warm finishes (Table 2). Protein was also higher in the later time of sowing which can be attributed to yield dilution effects (lower yield = higher protein). In 2016 however, the effect of time of sowing favoured the later sown crop given the cooler and wet conditions during grain fill. In addition to this, the first time of sowing was sown into marginal soil moisture, and germination across the plots was variable. Pre-emergent herbicide treatments did not affect final grain yield or quality.

Table 2. Summary of wheat grain yield, protein, test weight and screenings for time of sowing one and two at Hart, 2014 – 2016.

Year	Time of sowing	Grain yield	Protein	Test weight	Screenings
		t/ha	%	kg/hL	%
2014	4th May	4.1	10.2	81.6	3.0
	2nd June	2.9	11.4	81.5	3.0
	LSD (P≤0.05)	0.4	0.9	ns	ns
2015	30th April	2.2	9.4	81.1	1.7
	27th May	1.5	12.3	78.5	12.1
	LSD (P≤0.05)	0.1	0.8	0.8	1.4
2016	20th April	3.6	8.7	79.2	0.8
	2nd June	4.9	7.1	81.5	0.8
	LSD (P≤0.05)	0.2	0.1	0.4	ns

Starting soil moisture

The behaviour of pre-emergent herbicides in the soil is driven by three key factors; herbicide solubility, binding characteristics and rate of breakdown (Preston 2014). This trial focused on the influence of soil moisture conditions and rainfall on pre-emergent herbicide performance.

In two out of three seasons (2014 and 2015), moist soil conditions in late April meant a good germination of ryegrass had occurred prior ToS 1 (Figure 1a and b). The knockdown herbicide controlled the initial germination and the plots were sown into good moisture in 2014 and 2015. Even though more ryegrass was effectively controlled prior to sowing because of the ideal starts in 2014 and 2015, ryegrass was still found at moderate infestation levels (18-77 plants/m^2) in the nil control (Table 3).

In 2016 however, plots were sown into marginal moisture (Figure 1c) and there was little ryegrass germination prior to ToS 1. Furthermore, the dry sowing conditions resulted in patchy crop establishment for ToS 1 (96 plants/m^2) compared to ToS 2 (158 plants/m^2; data not shown), and more ryegrass was consequently found in ToS 1 where the competitive ability of the crop had been compromised (Table 3).

In all three seasons soil moisture conditions were similar and favourable prior to sowing ToS 2, with good rainfall received the week leading up to sowing (Figure 1).

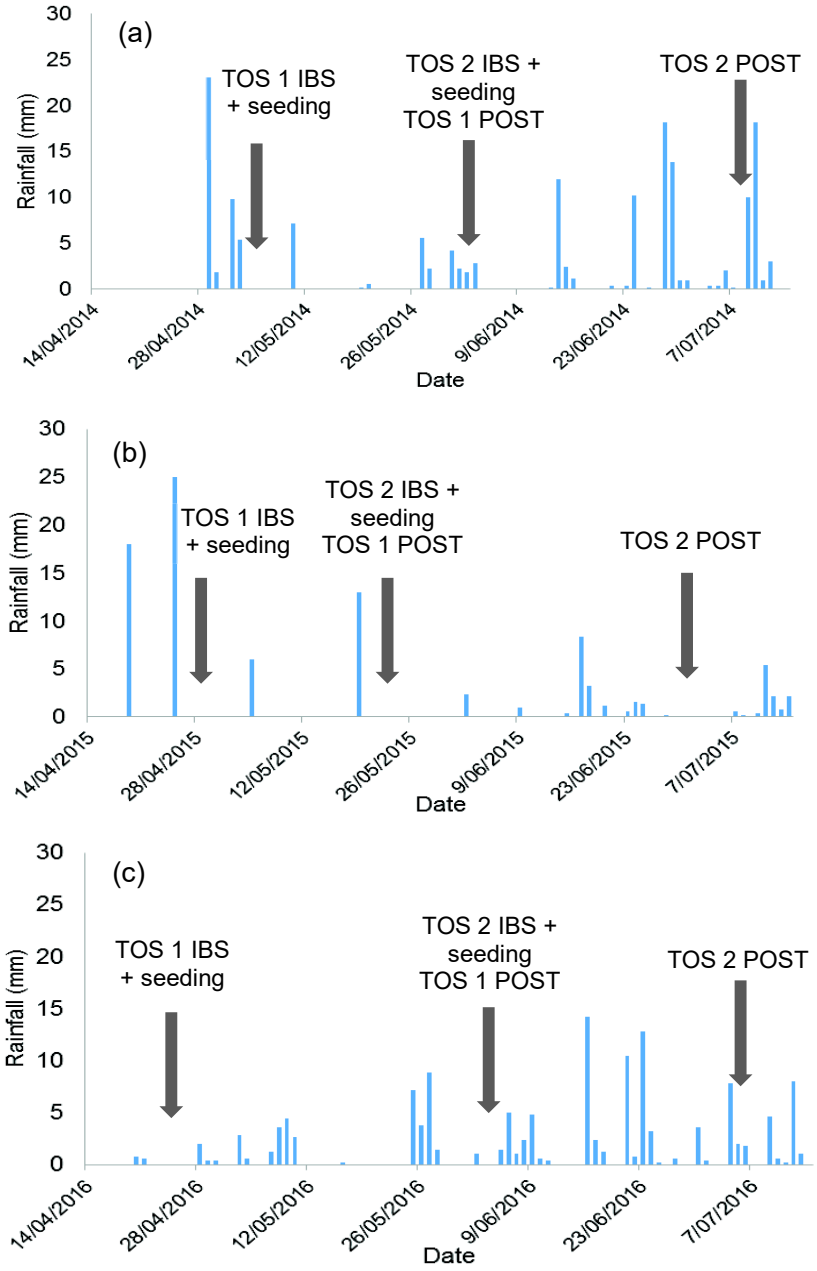

Figure 1. Starting season rainfall from 14th of April through 14th of July at Hart in (a) 2014, (b) 2015 and (c) 2016. Seeding and herbicide application dates indicated.

Pre-emergent herbicide activity and annual ryegrass control

Across the three seasons all pre-emergent herbicides provided similar control regardless of sowing date (Table 3). Early ryegrass counts showed all pre-emergent herbicides reduced ryegrass numbers compared to the control. Boxer Gold was particularly effective in the drier years, however it did appear to run out of steam when growing conditions were extended. Sakura appeared to provide better control in the wetter year, however spilt application of Boxer Gold (IBS plus POST) was just as effective. Sowing time had little or no effect on the performance of pre-emergent herbicides against ryegrass.

Despite the contrasting starts to each season, and better opportunities for knockdown weed control, delayed sowing provided little or no advantage over early sowing in reducing ryegrass numbers or seed set. The exception to this was last season, with fewer ryegrass in ToS 2, where there was plenty of opportunity for knockdown control as sowing was delayed by more than 6 weeks (20th April versus 2nd June). Similar research (Preston 2016) has shown that ryegrass appears to be synchronising its germination more with the sowing operation, meaning that irrespective of the time of sowing most ryegrass is emerging after the crop has been sown. Such changes in germination behaviour of ryegrass would therefore compromise the effectiveness of delayed sowing.

Table 3. Effect of different pre-emergent herbicides on annual ryegrass density (plants/m^2) at Hart, 2014 - 2016.

Herbicide treatment	2014		2015		2016	
	ToS 1	ToS 2	ToS 1	ToS 2	ToS 1	ToS 2
	Ryegrass density (plants/m^2)					
T1 (nil)	59	77	18	6	42	13
T2	21	12	3	1	17	33
T3	8	8	1	2	12	13
T4	6	12	2	2	25	15
T5	3	3	0	1	22	8
T6	8	6	1	2	17	14
Average	***17***	***20***	***4***	***2***	***23***	***16***
ToS x Herb (P≤0.05)	*ns*		*ns*		*19*	
Herb (P≤0.05)	*11*		*5*		*-*	

Not surprisingly similar responses to weed density were observed for ryegrass head numbers. Pre-emergent herbicides which provided greatest reduction in weed density were also the most effective at reducing ryegrass seed set (Table 3 and 4). There was however a significant effect (P≤0.05) of both herbicide, ToS, and their interaction on ryegrass head density in every year of the study. Even though ryegrass densities were similar between ToS treatments in 2015 and 2016, ryegrass seed set appeared higher for ToS 2 treatments. The early sown wheat appeared to be far more competitive than the later sown crop and as a consequence reduced ryegrass head production. Furthermore, in the absence of competition ryegrass heads in the delayed sown plots were visually more obvious and were situated higher in crop canopy (Figure 2).

Table 4. Effect of different pre-emergent herbicides on annual ryegrass head numbers (heads/m^2) at Hart, 2014 - 2016.

Herbicide treatment	2014		2015		2016	
	ToS 1	ToS 2	ToS 1	ToS 2	ToS 1	ToS 2
	Ryegrass heads (heads/m^2)					
T1 (nil)	350	164	45	44	116	99
T2	74	35	5	9	43	37
T3	39	41	3	13	12	15
T4	20	36	6	14	41	52
T5	32	9	0	15	37	35
T6	71	14	8	9	45	35
Average	***98***	***50***	***11***	***17***	***49***	***46***
ToS x Herb (P≤0.05)	*89*		*12*		*21*	

Figure 2. Nil treatment - first time of sowing (left) compared to second time of sowing (right), photo taken on 17 September, 2014. Note the healthier looking ryegrass in the less competitive later sown crop (right). Source: C. Preston.

Summary and implications

The results of this study suggest:

- Delayed sowing provided no advantage over early sowing in reducing ryegrass plant and head numbers.
- Wheat sown early is generally more vigorous and competitive against ryegrass.
- Time of sowing had no effect on the performance of the different pre-emergent herbicides.
- Wheat yields were higher with early sowing, the exception was last season where the delayed sown wheat was able to better capitalise on the extended growing season.

Some points worthy of consideration:

- Sowing under dry conditions may effect herbicide incorporation, particularly on heavier soils, were poor tilth can result in shallow sowing and/or cloddy conditions; this may effect herbicide performance but also jeopardise crop safety.
- Whilst most of the new pre-emergent herbicides are relatively stable, exposure to extended periods of dry have been shown to adversely affect performance; most pre-emergent herbicides work best under moist soil conditions.

References

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Acknowledgements

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